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A Review Paper on PLC & Its Applications in Industrial Automation

[1]Salava V Satyanarayana, [2]Garnepudi Sai Rajasri, [3]Ati Hari Prasad

[1]Assistant Professor, [2, 3]UG Scholar,
[1, 2, 3] EEE, Hyderabad Institute of Technology & Management,
Hyderabad , India
Email - [1]pshve2011@gmail.com, [2]gsrajasri2@gmail.com, [3]harryhari555@gmail.com

Abstract: *This paper describes how the present automation system comes in to existence through its various paths. In the past, automation is done through contractor and relay logics. Since the human intervention is more, the scope of errors was also in increased manner. In order to overcome those errors, PLCs (Programmable Logic controllers) along with SCADA come in to use. These have reduced human intervention errors, which in turn has increased accuracy, precision and efficiency. This paper gives the elaborated knowledge on basics of PLC and its applications for a person who wants to choose their career in Industry automation sector. In this paper the ladder programming explained clearly along with industrial applications like, how providing lube for the gear box before the lathe spindle start to run which aims to ensure that the oil pump motor starts initially before main motor and the main motor starts subsequently.*

Key Words: *Programmable Logic controller (PLC), SCADA, Automation*

1. INTRODUCTION:

PLC stands for "Programmable Logic Controller". A PLC is a ruggedized computer specially designed to operate reliably under harsh industrial environments – such as extreme temperatures, wet, dry, and/or dusty conditions. It is used to automate industrial processes machine function or even entire production line such as a manufacturing plant's assembly line, an ore processing plant, or a wastewater treatment plant. PLC plays a crucial role in the field of automation, using larger SCADA systems. A PLC can be programmed based on the operational requirement of the process. In the manufacturing industry, there will be a need for reprogramming a any stage due to the change in the nature of production. To overcome this difficulty, PLC based control systems were proposed

1.1. PLC WORKING:

The working of a PLC can be better to understood as a cyclic scanning method called, scan cycle. A PLC Scan Process includes the following procedure

- The operating system starts cycling and monitoring of time.
- The CPU starts reading the data from the input module and it checks the status of all the inputs.
- The CPU starts executing the user or application program written in relay-ladder logic or any other PLC-programming language.
- Next, the CPU performs all the internal diagnosis and communication tasks.
- According to the program output, it writes the data into the output module so that all outputs are updated.
- This process continues up to the PLC is in run mode.

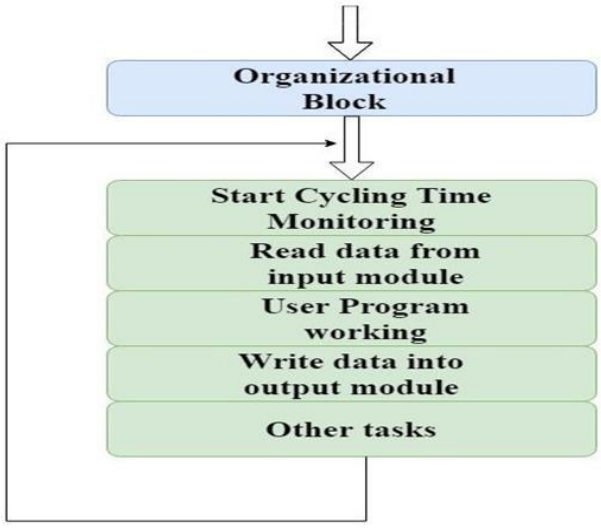
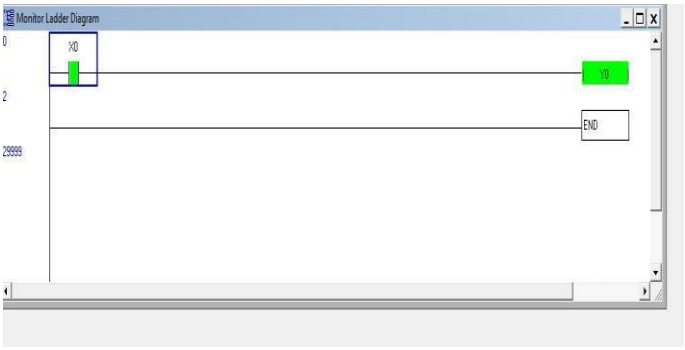


Figure: PLC Scan cycle block diagram

1.2. BASIC LADDER DIAGRAM :

MOTOR WITH SINGLE SWITCH



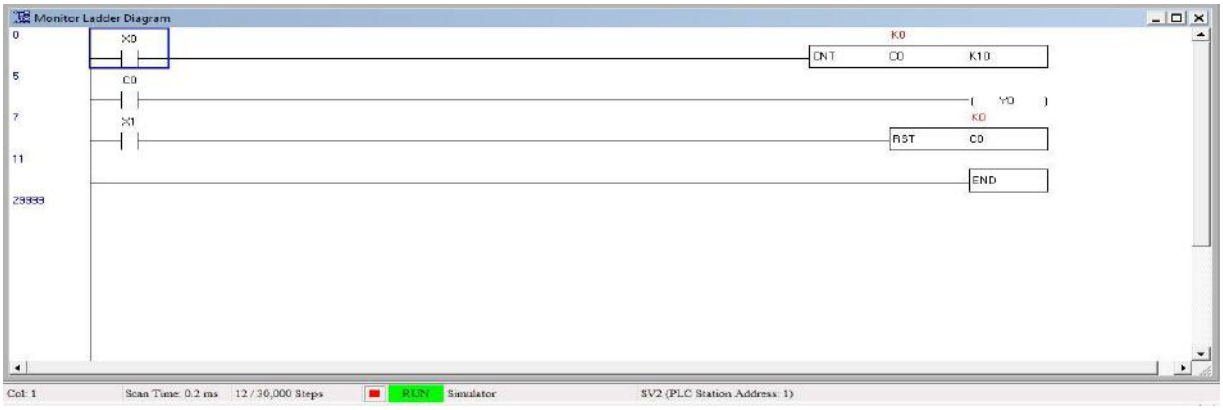
PLC Industrial Applications:

2. Daily Production:

The production line may be powered off accidentally or turned off for noon break. The Program is to control the counter to retain the counted number and resume counting after the power is ON again. When the daily production reaches 10, the target completed indicator will be ON as a reminder to the operator for keeping a record. Press the Clear button to clear the past history records. The counter will start counting from 0 again up to 10.

Devices:

Device	Function
X0	Photoelectric sensor. Once detecting the products, X0 will be ON.
X1	Clear button
C10	Counter: 16-bit counting up (latched)
Y0	Target completed indicator



Program Description:

The latching counter is demanded for the situation of retaining data when power-off.

When a product is completed, C10 will count for one time. When the number reaches 10, target completed indicator Y0 will be ON.

2.1. Conditional control logic circuit:

In an Industry, providing the lube for the gear box before the lathe spindle starts to run which aims to ensure that the oil pump motor starts first and the main motor starts subsequently, to achieve this condition the ladder circuit logic shown in below figure. For this the components required are also listed in below tabular column. The working of the ladder logic for this conditional circuit was explained.

Device	Content
X0	Oil pump START button. X0 will be ON when pressed
X1	Main motor START button. X0 will be ON when pressed.
X2	Oil pump STOP button. X2 will be ON when pressed
X3	Main motor STOP button. X3 will be ON when pressed
Y0	Oil pump motor Output
Y1	Main motor Output

Figure 2.Oil pump

3. WORKING PROCEDURE:

- ✓ This program is a typical application of the conditional control circuit. Y0 = ON when Oil Pump START button is pressed. Therefore, the oil pump will start to provide lube for the gear box of main motor(Y1)
- ✓ Under the precondition of the operating state of the Oil pump, the main motor (Y1) will be ON when the Main motor START button is pressed.
- ✓ During the operation of main motor (Y1), oil pump (Y0) needs to provide lube continuously.
- ✓ The oil pump will be stopped when Oil pump STOP button X2 is activated, and the main motor will be stopped when Main motor STOP button X3 is activated.

4. RESULTS:

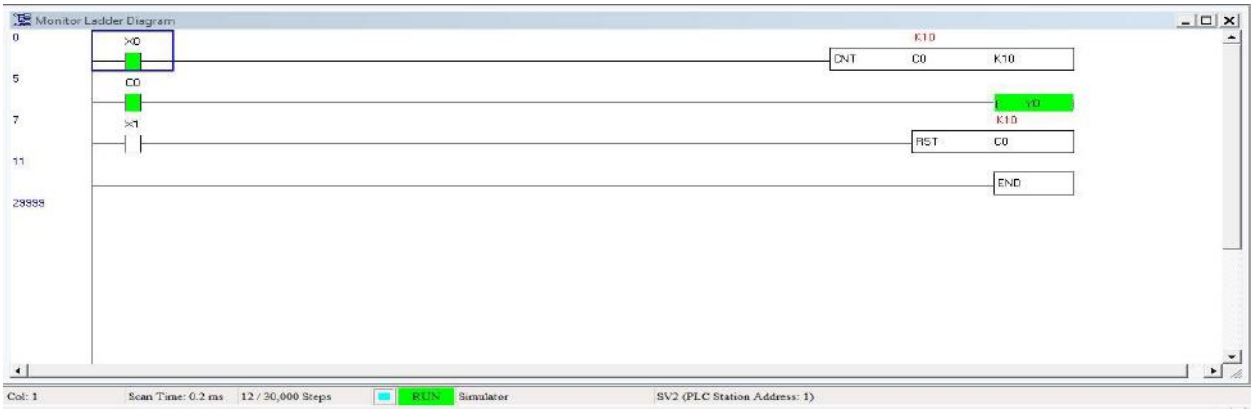


Figure 3. Daily Production output

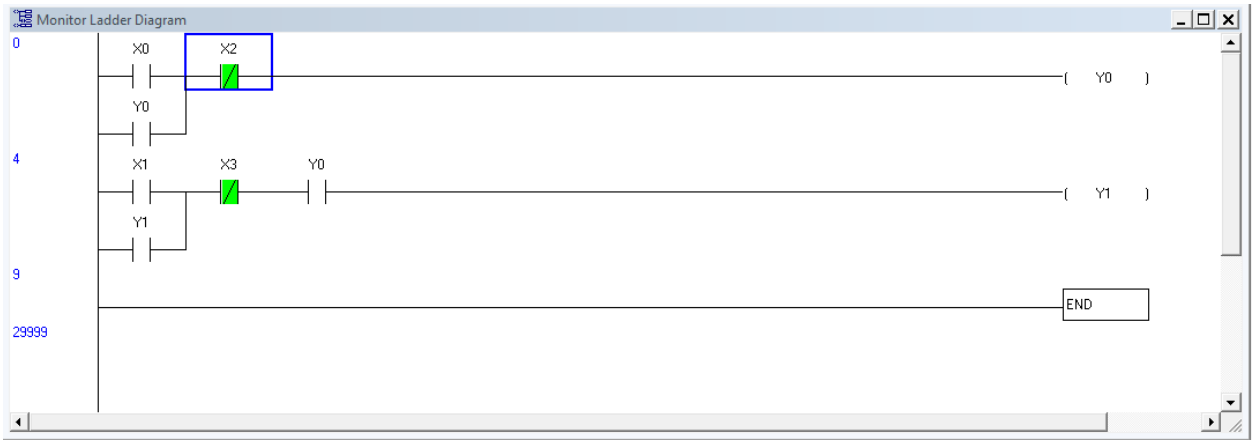


Figure 4. Oil pump and Main motor output

5. CONCLUSION:

The soft wiring advantage provided by programmable logic controllers was an excellent feature. Soft wiring makes modifications in the control system were easy and flexible. If any device in a PLC system to behave differently or to control a different process element, all have to do is modify the control logic Program. In a traditional system, making this type of modification would involve physically changing the wiring between the devices, a costly and

time-consuming procedure. In this paper, some of the industrial applications like daily production and conditional control circuits were explained.

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